

# Wallace & Tiernan<sup>®</sup> Liquid Feed Systems Chemtube<sup>®</sup> 2000 Diaphragm Metering Pump

**SIEMENS**

## Introduction

The Chemtube<sup>®</sup> 2000 Metering Pump is the latest arrangement of a long and experienced line of high capacity, hydraulically actuated, tubular diaphragm metering pumps. Designed for long service under the severest conditions, the Chemtube<sup>®</sup> 2000 offers accurate metering of a wide variety of chemicals for any process application. Together with other outstanding lines of metering pumps such as the Encore<sup>®</sup> 100 and Encore<sup>®</sup> 700 mechanical diaphragm pumps, the Chemtube<sup>®</sup> 200 low capacity hydraulic diaphragm pump and the Premia<sup>®</sup> 75 solenoid operated metering pumps, Siemens Water Technologies can provide a complete chemical feed system or package for any application in any industry.

## Features

- Hydraulically actuated tubular diaphragm that can handle capacities up to 2000 lph (5280 gph) and backpressure to 13 bar (2000 psi). A double simplex arrangement is available for capacities up to 4000 lph (1056 gph)
- Three piston sizes and four stroking speeds ensure a pump sized for your application without sacrificing operating range

- A rugged cast iron gearbox for long operational life in harsh conditions. The compact design takes up less space for economical installation and flexibility
- An optional Teflon-lined diaphragm combined with a choice of PVC, Kynar<sup>®</sup> or 316 SS valve materials provides for the ultimate chemical compatibility with virtually any liquid chemical
- Cartridge-type valves for fast, foolproof service without the need to remove or disassemble piping
- A mechanical, integral automatic hydraulic refill system requires no adjustment and maintains a hydraulic balance regardless of operating conditions.



## Benefits

- Hydraulically actuated tubular diaphragm can handle capacities up to 2000 lph
- Three piston sizes
- Four stroking speeds
- Rugged, cast iron gearbox
- Cartridge type valves for fast foolproof service without the need for pipe removal or disassembly

## Typical applications

Typical Industries	Typical applications. metering and pumping
Water and wastewater treatment	Coagulants, oxidising agents, disinfectants, corrosion inhibitors, chemicals for taste, odour and pH control
Swimming pools	Acids, caustics, disinfectants and oxidising agents
Food processing	Bactericides, algacides, acids, caustics, detergents, corrosion inhibitors and lubricants
Chemical processing	Additives for petrochemical, pharmaceutical, pulp and paper, plastics and textile manufacture
Brewing and distillation	Filtration and fermentation aids, bactericides, acids, caustics and detergents
Agriculture	Fertilisers, herbicides, pesticides and food supplements

## Features

### Cartridge valves for a wide range of operations

Suction and discharge valves are designed as cartridges which are compression sealed to the pump head and pipe connection by o-rings. These valves are easily removed for service or replacement by loosening the clampdown bolts. There is no need to remove or disturb the piping connections. Valve materials are available in PVC, Kynar® or 316 SS in either a single or double ball configuration. A special arrangement is available for slurries utilising a ceramic seat with a polyurethane ball for maximum abrasion resistance. A spring-loaded ball configuration is available for handling high viscosity liquids such as polymers.



### Non-loss-motion stroke adjustment

The most common means of changing the output of the metering pump is to vary the stroke length of the piston, which drives the hydraulic fluid. The Chemtube® 2000 pump uses a variable eccentric to provide for a smooth, non-loss-motion stroke adjustment. This results in a sinusoidal fluid velocity profile at all stroke lengths providing reliable, efficient operation with minimum "hydraulic shock" to the pump and piping system. Adjusting the stroke length simply alters the amplitude of the sine wave.

### Hydraulically balanced tubular diaphragm

The tubular pumping diaphragm design provides a straight through flow path, which is ideal for high flowrates and slurries or high viscosity fluids. An intermediate hydraulic fluid surrounds the tubular diaphragm and is separated from the gearbox hydraulics by a flat disc diaphragm. This isolates the process fluid from the gearbox oil. The tubular diaphragm is also hydraulically balanced (same pressure inside and outside) for accurate feedrates and long service life at high pressures.

### Optional teflon lined tubular diaphragm

For chemical compatibility with a wide range of harsh, corrosive chemicals, a unique, optional Teflon lined tubular diaphragm (patent-pending) is available. Standard diaphragms are available in Hypalon or Viton for most chemical applications.

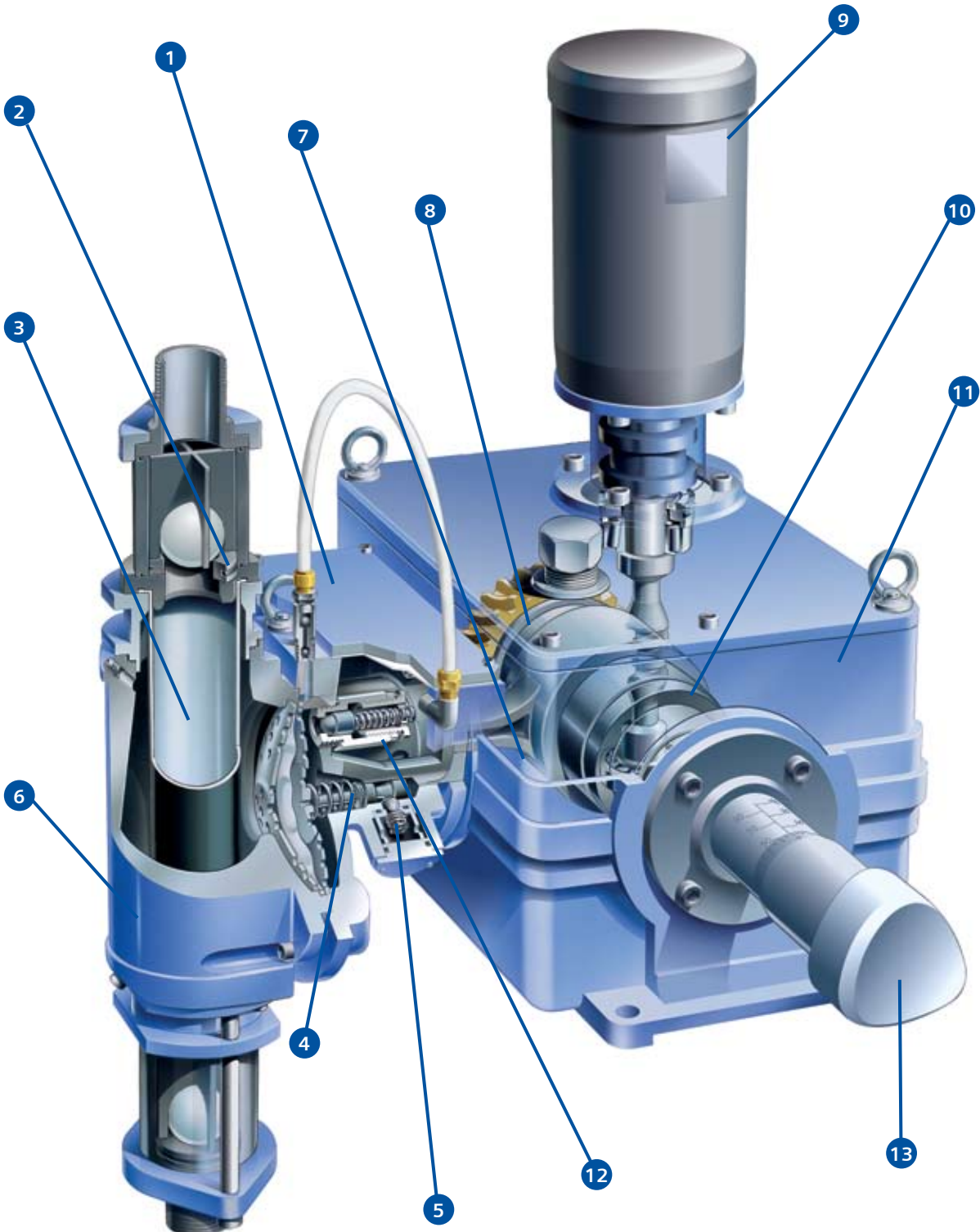


## Operation

The liquid end uses two diaphragms to isolate the process fluid from the hydraulic fluid in the gearbox. The tubular diaphragm, which handles the process fluid is surrounded by a 50/50 water/propylene glycol mixture. A flat disc diaphragm separates the intermediate fluid from the gearbox hydraulic oil. There are no mechanical connections between the two diaphragms and the pump drive. Both diaphragms are hydraulically balanced during pump operation. The disc diaphragm is driven by the gearbox oil, which in turn is driven by the reciprocating pump piston. The piston causes the liquid in the intermediate chamber

to displace the tubular diaphragm and create pumping action with each piston stroke. Varying the stroke length or speed of the piston changes the capacity of the pump.

An internal pressure relief valve protects the pump drive and piping components from an overpressure condition that could be caused by a blocked discharge line or closed valve. An integral air purge valve together with an oil refill valve maintain the integrity of the hydraulic system under all pumping conditions for consistent accuracy and long, operator free operation.



- 1 AIR PURGE VALVE**

An air purge valve automatically removes any trapped air from the hydraulic fluid to maintain pumping accuracy.
- 2 CARTRIDGE VALVES**

Cartridge-type suction and discharge valves are used for fast service without removing or disconnecting piping. The design includes wide flow paths and four-point guides to control ball rise and ensure proper seating.
- 3 TUBULAR DIAPHRAGM**

The tubular diaphragm provides a straight-through flow path for the process chemical. It is available in Viton or Hypalon construction as standard with an optional Teflon lined configuration available.
- 4 SECONDARY DIAPHRAGM**

This flat Teflon diaphragm separates the hydraulic gearbox oil from the intermediate fluid that surrounds the tubular diaphragm. This provides an extra measure of isolation from the process fluid. This diaphragm also serves to activate the oil refill valve when necessary.
- 5 OIL REFILL VALVE**

The oil refill valve maintains a sufficient volume of hydraulic fluid in the pump chamber to provide proper pump operation. As hydraulic fluid is lost in minute quantities through the air-purge valve and the piston/cylinder interface, the secondary diaphragm will eventually flatten against the rear baffle plate. The oil refill valve senses the position of the diaphragm against the baffle plate and combined with a vacuum condition in the pump chamber allows oil replenishment to the pump chamber. There are no valves to adjust and since two conditions must co-exist for the refill valve to operate, overfilling of the pump chamber cannot occur even in the case of excessive suction lift or a blocked suction line.
- 6 OPTIONAL DIAPHRAGM LEAK DETECTOR**

An optional diaphragm leak detector senses the early stages of diaphragm failure. A sensor monitors the intermediate fluid for any change in conductivity, which indicates that either the process chemical or hydraulic oil is mixing with the intermediate fluid due to a diaphragm leak. A remote alarm is initiated to alert the operator.
- 7 PISTON**

The piston reciprocates within the pump cylinder to provide the pumping action. A close tolerance fit eliminates the need for piston seals.
- 8 GEAR SETS**

Four combinations of worm gear and worm shaft are available to provide stroking speeds of 36, 72, 96, and 144 stroked per minute.
- 9 MOTOR**

Available with standard induction and variable speed motors (optional) for wider operating ranges and automatic process control.
- 10 DRIVE UNIT**

The stroke length is adjusted through a heavy duty, variable eccentric design that provides for non-loss motion operation.
- 11 ROBUST GEARBOX**

The compact gearbox features liberal use of heavy duty parts including an epoxy-painted cast iron housing, 316 SS fasteners, load absorbing tapered roller bearings, robust gears and steel nodular iron drive components.
- 12 PRESSURE RELIEF VALVE**

An integral, internal pressure relief valve protects the diaphragm and drive unit from overpressure by relieving hydraulic fluid back to the gearbox. The valve is field-set to relieve at 10-15% above the process pressure. This eliminates the need for an external pressure relief valve in the discharge piping system.
- 13 STROKE ADJUST KNOB**

A 10-turn micrometer-type stroke adjuster to obtain precise and highly repeatable feed rate settings. A percent scale and vernier indicate stroke length in 0.25% increments. Feed rate is infinitely adjustable from 0 to 100%. Automatic stroke length control is available with a motor-operated positioner.

## Manual and automatic stroke length control

The Chemtube® 2000 metering pump can be controlled by varying the stroke length or stroke frequency. The following control schemes are available:

- Manual or Remote Manual Control
- Start-Stop Control where the motor is wired into the circuit of a transfer pump, switch, timer or controller
- Flow Proportional Control from a single process variable
- Residual, Compound Loop or Setpoint Control using one or two process variables

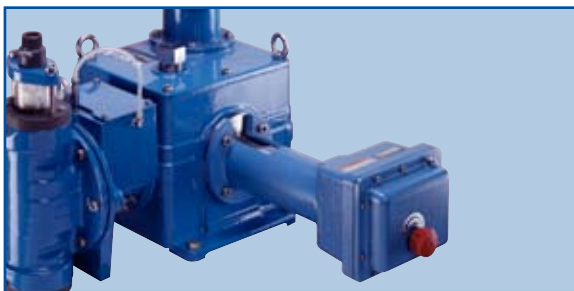
### Manual Stroke Length Control

A 10 turn micrometer gives continuous feed rate adjustment over a 10:1 range. A percent scale and vernier indicate stroke length setting to 1 part in 400. Each revolution of the knob changes feed rate by 10%. Stroke length is infinitely adjustable from 0 to 100%.



### Automatic Stroke Length Control

For automatic capacity control via stroke length, IP 65 actuator is used in conjunction with either of two process variable controllers. The compact, actuator easily installs on the pump and features local manual override and a window for clear indication of stroke length. Two microprocessor-based controllers are available:



### SCU, Signal Conditioning Unit

The economical SCU gives automatic process control in response to one process variable, typically flow rate. Housed in an IP 65 enclosure, the SCU features an 8-character alphanumeric LCD display with 6-button keypad and menu-driven operator prompts for simple operation, setup and calibration. Input flow scaling

and output dosage adjustment allow independent scaling from 10 to 400%.

See publication TI. 40.100.GE for more details.



### Variable Speed Control

For precise and accurate feed rate control via stroking speed, an SCR Drive Unit varies the speed of a DC pump motor. Stroke frequency can be regulated manually by potentiometer setting, or automatically via a 4-20 mA process variable input signal (optional). Closed-loop speed regulation provides feed rate control accurate to 1% of full scale. With continuous adjustment over a 20:1 range, total operating turndown with water-like solutions is 200:1. Dosing or scaling of a process variable can be accomplished by means of an SCU, Signal Conditioning Unit used in conjunction with an SCR drive. For more complex control, a PCU, Process Control Unit can be used to provide setpoint control in response to two process variables, such as plant flow and chlorine residual.



### PCU, Process Control Unit

The PCU is a full feature setpoint controller. It provides automatic process control in response to two process inputs, typically flow rate and chlorine residual. The PCU can operate in any of four different control modes including residual feedback, compound loop, dual signal feed forward (for dechlorination) and flow proportional. In addition, the PCU can be configured for "centre-zero" operation in compound loop mode when a DEOX/2000® Dechlorination Analyser is used. Housed in an IP 65 enclosure, the PCU features a large alphanumeric display, an LED bargraph to indicate flow input or actuator position in 5% increments, a 6-button keypad and menu driven operator prompts for simple operation, setup and calibration.

For more information see publication TI.40.200.GE

## Technical data

CAPACITY SPECIFICATION AND MOTOR SELECTION															
Piston size mm	50 Hz 1450 rpm			60 Hz 1450 rpm			Maximum Discharge Pressure (bar)							Cartridge Valves	
	Stroke frequency stroke/min	Capacity*		Stroke frequency stroke/min	Capacity*		Motor kilowatts @ 1450rpm - Induction (Variable Speed)								
		lph	gph		lph	gph	Simplex				Double Simplex				
							0.37 (0.55)	0.55 (0.75)	0.75 (1.11)	1.11 (1.49)	1.49 (2.24)	0.75 (1.11)	1.49 (2.24)		2.24 (3.73)
51	30	144	38	36	175	46	8	12	13.3						R1 or 1" NB socket
	60	291	77	72	350	92	6	8.7	12	13.3	10	13.3			
	80	390	103	96	467	123	4	6	8	8.7	13.3	6.6	13.3		
	120	583	154	144	700	185	4	6	8	8.7	13.3	6.6	13.3		
	144	700	185				4	6	8	8.7	13.3	6.6	13.3		
64	30	249	66	36	299	79	8.3				8.3				R1 1/2 or 1 1/2" NB socket
	60	498	132	72	598	158	4.7	7	8.3		5	8.3			
	80	666	176	96	799	211	3.3	5	7	8.3	5	8.3	8.3		
	120	1000	164	144	1200	317	2.3	3.3	4.7	7	8.3		3.3		
	144	1200	317				2.3	3.3	4.7	7	8.3		3.3		
76	30	416	110	36	500	132	5				5				R2 or 2" NB socket
	60	833	220	72	1000	264	2.7	4.3	5		3.3				
	80	1110	293	96	1333	352	2	3	4	5		3.3	5		
	120	1667	440	144	2000	528	1.3	2	2.7	4	5	2	5		
	144	2000	528				1.3	2	2.7	4	5	2	5		

\*Reflects simplex capacity, double-simplex arrangements must be configured with same stroke-frequency on both liquid ends.

### Accuracy

Repeatable metering accuracy is (1% of full scale, at constant hydraulic conditions, over a 10:1 range.

### Stroke Length

44.45mm (13/4")

### Stroking Speeds

For 50 Hz operation, 5 stroking speeds are available: 30, 60, 80, 120, and 144 strokes/minute.

For 60 Hz operation, 4 stroking speeds are available; 36, 72, 96 and 144 strokes/minute.

### Feed Rate Adjustment

Feed Rate is infinitely adjustable from 0 through 100%. A percent scale and vernier indicate stroke length setting in 0.25% increments. Each revolution of the knob changes stroke length by 10%.

### Operating Range

Stroke length is adjustable over a 10:1 range. Stroke frequency is adjustable over a 20:1 range (using an optional variable speed drive). Total combined maximum operating turndown can be as high as 200:1. Above 100:1 continuous turndown, total available operating range should be evaluated against specific chemicals being metered.

### Speed of Response

Automatic stroke length control response time is 100 seconds from 0 to 100%. Variable speed control response time is under 3 seconds from 0 to 100%.

### Suction Lift

Flooded suction is recommended. The pump will self-prime with a 1.5m of water suction lift (wetted valves, zero backpressure, full stroke and speed, waterlike solutions). Once primed, the pump will operate with a 1.5m of water suction lift.

### Polymer and Slurry Handling Capabilities

Polymer solutions up to 10,000 centipoise (Brookfield Viscometer with # 2 spindle @ 12 rpm) under any condition. Higher viscosities (up to 20,000 centipoise) with decreased capacity (10-15%).

Hydrated lime slurries up to 9.77 g/l (3.8 pounds per gallon of water); activated carbon slurries up to 2.82 g/l (1.1 pounds per gallon); diatomaceous earth slurries up 4.37 g/l (to 1.7 pounds per gallon) of water.

### Process Fluid Temperature Limits

82°C (180°F) for 316 SS Valves  
 65°C (150°F) for Kynar® Valves  
 52°C (125°F) for PVC Valves  
 Ambient Temperature Limits  
 -12 to 52°C (10-126°F)

### Materials of Construction

Gear Box and Liquid End Housing  
 epoxy painted, cast iron  
 Automatic Actuator Enclosure:  
 epoxy painted, aluminium  
 Suction and Discharge Valve Housings:  
 grey PVC, Kynar® or Teflon

**Valve Balls:**

316 Stainless Steel, Teflon, Ceramic, Polyurethane (for slurry service)

Valve Seats: 316 Stainless Steel, PVC, PVDF, Ceramic (for slurry service)

**Valve Seals:**

Hypalon, Viton or Teflon

**Tubular Diaphragm:**

Hypalon, Viton, or Teflon

**Mounting Base:**

Painted Steel

**Electrical Requirements**

Standard induction motor arrangement is 1725 rpm, 115/230 Volts, 50/60 Hz, single phase, TEFC, UL Listed, CSA Approved. Motors with other electrical characteristics are available as an option. The optional diaphragm leak detector requires 115 Volts, 50/60 Hz. Resistivity adjustable from 1,000 to 100,000 ohms. NC/NO relay rating 13 Amps @ 120 Volts. NEMA 4 enclosure. Optional automatic stroke length actuator has 3 alarm contacts (high, low, actuator disengaged) N.O. rated 5 Amps @ 250 Volts.

**Chemical Metering Systems**

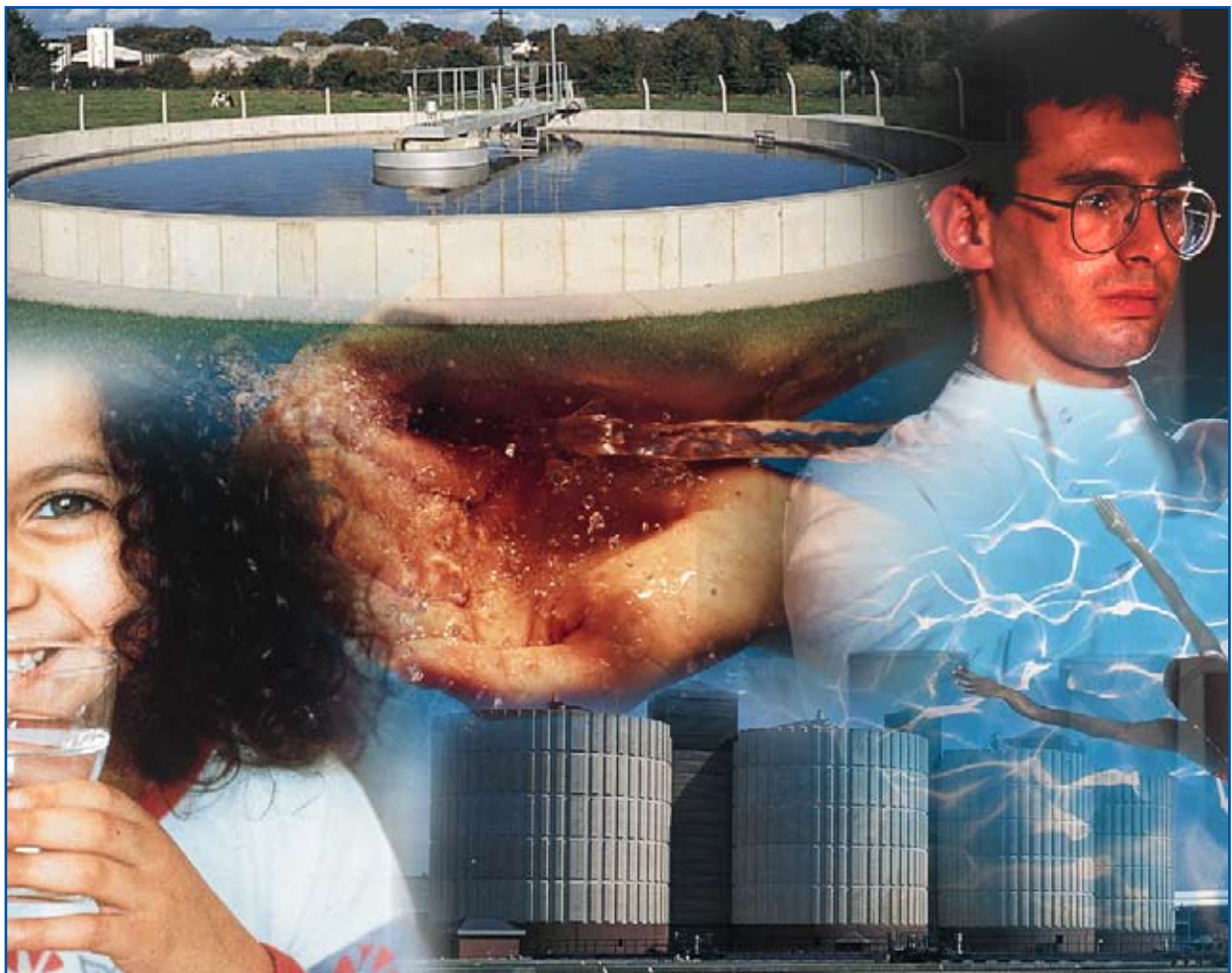
Low cost packaged systems can be custom configured from standard stock components including tanks, mixers, instrumentation and a wide range of controls. All systems are shipped assembled, prewired and ready to install.

**Accessories**

Choose from Back Pressure Valves, Antisyphon Valves, Main Connections, Strainers, Pulsation Dampeners, Calibration Chambers, Solution Tanks, Mixers, Liquid Level Switches, Slurry Flushing Systems and numerous Mounting Accessories, just to name a few.

**PM™ Kits**

Preventative Maintenance kits contain original Siemens Water Technologies replacements for those parts most susceptible to wear. They ease scheduled maintenance and help maintain equipment in good working order, eliminating equipment breakdowns and costly downtime.



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